

Climate and forests: bridging **Governance** and **Carbon**

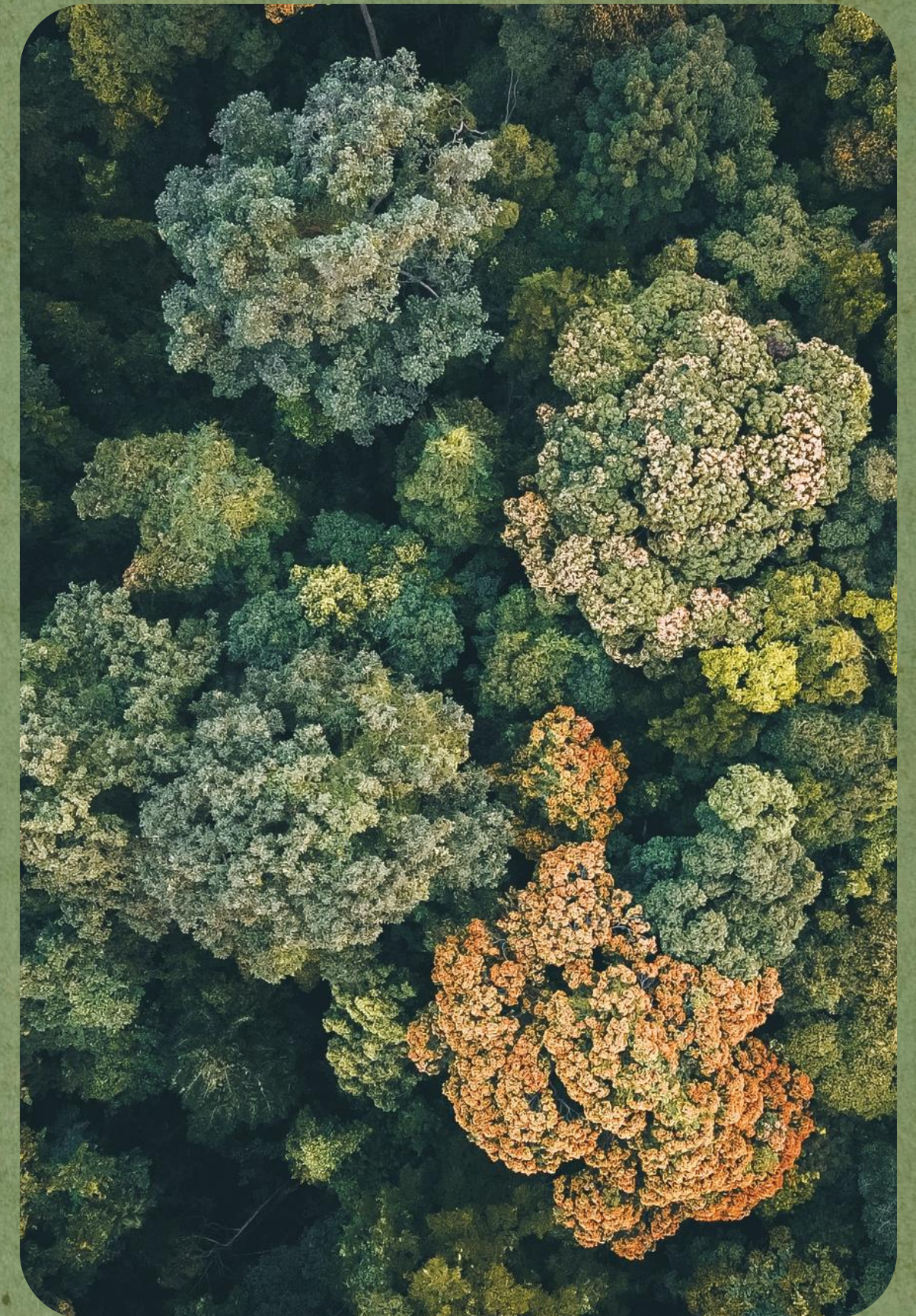
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PennState



KEYSTONE STATE



Eastern Hemlock (*Tsuga canadensis*)



FOR308- Forest Ecology (PSU)

Relevant ecosystem properties for:

- Stream ecology: trout.
- Lots of vertebrate and invertebrate microhabitats.
- 96 species of birds, 9 of which are highly dependant on hemlocks
- 47 species of mammals.
- Shaded, cold and humid environments.
- Erosion control.



KEYSTONE SPECIES

- Unique role in the food web
- Ecosystem engineers
- Disproportionate impact on the ecosystem



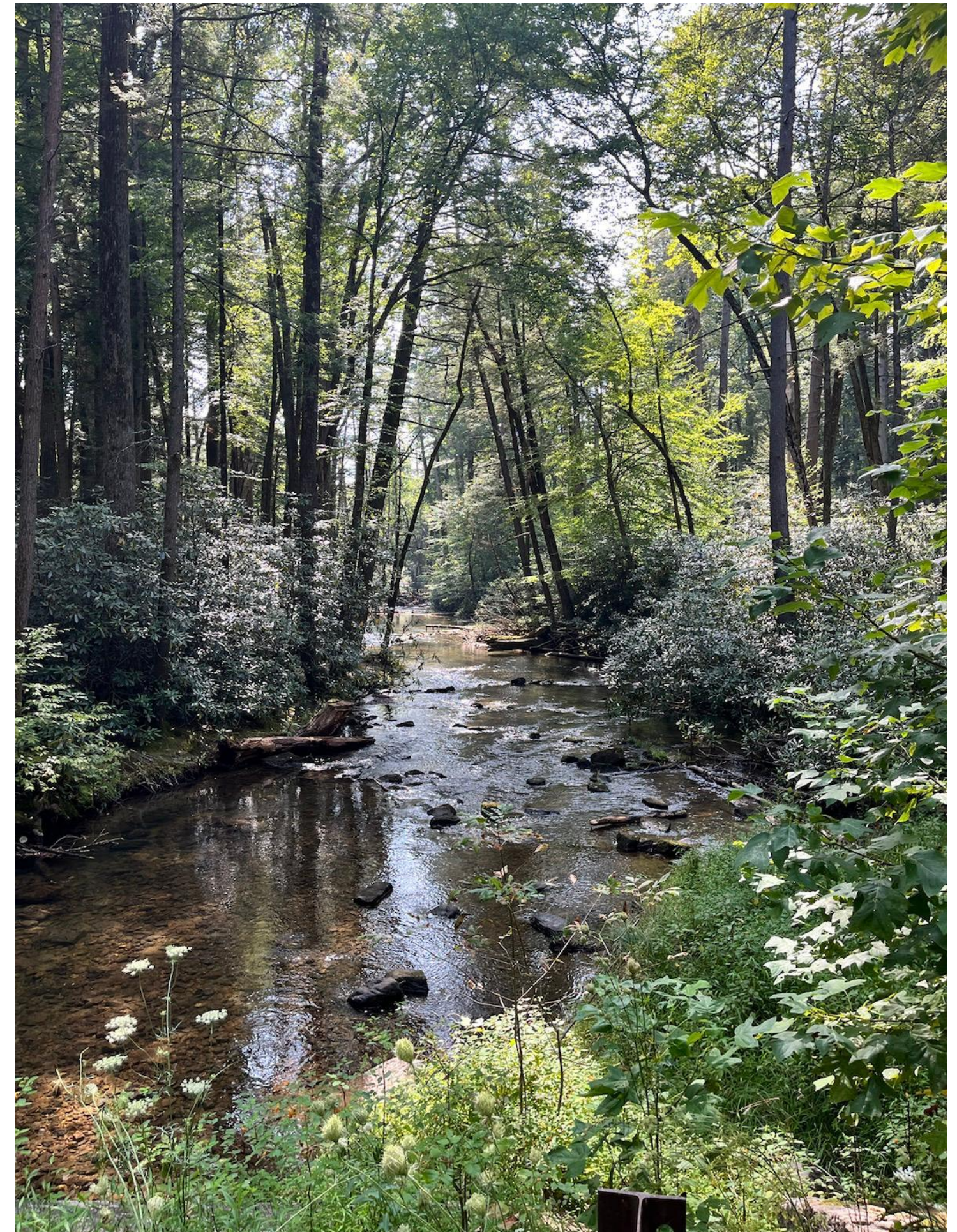
Climate Change and PA forests

- Average Temperature: 50°F (+7-8°F)
- Annual Precipitation: 41 in
 - 5-12% increase projected
 - Fall, winter, and spring -> summer drought

Consequences...

- Mortality of native trees due to:
 - Drought
 - New/increased insects and pest populations
 - Increased **strength** and **frequency** of storms
- Arrival of novel species (trees, **pests and pathogens**)
- Shift in species distributions

KEYSTONE SPECIES



Climate Change and PA forests

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KEYSTONE SPECIES

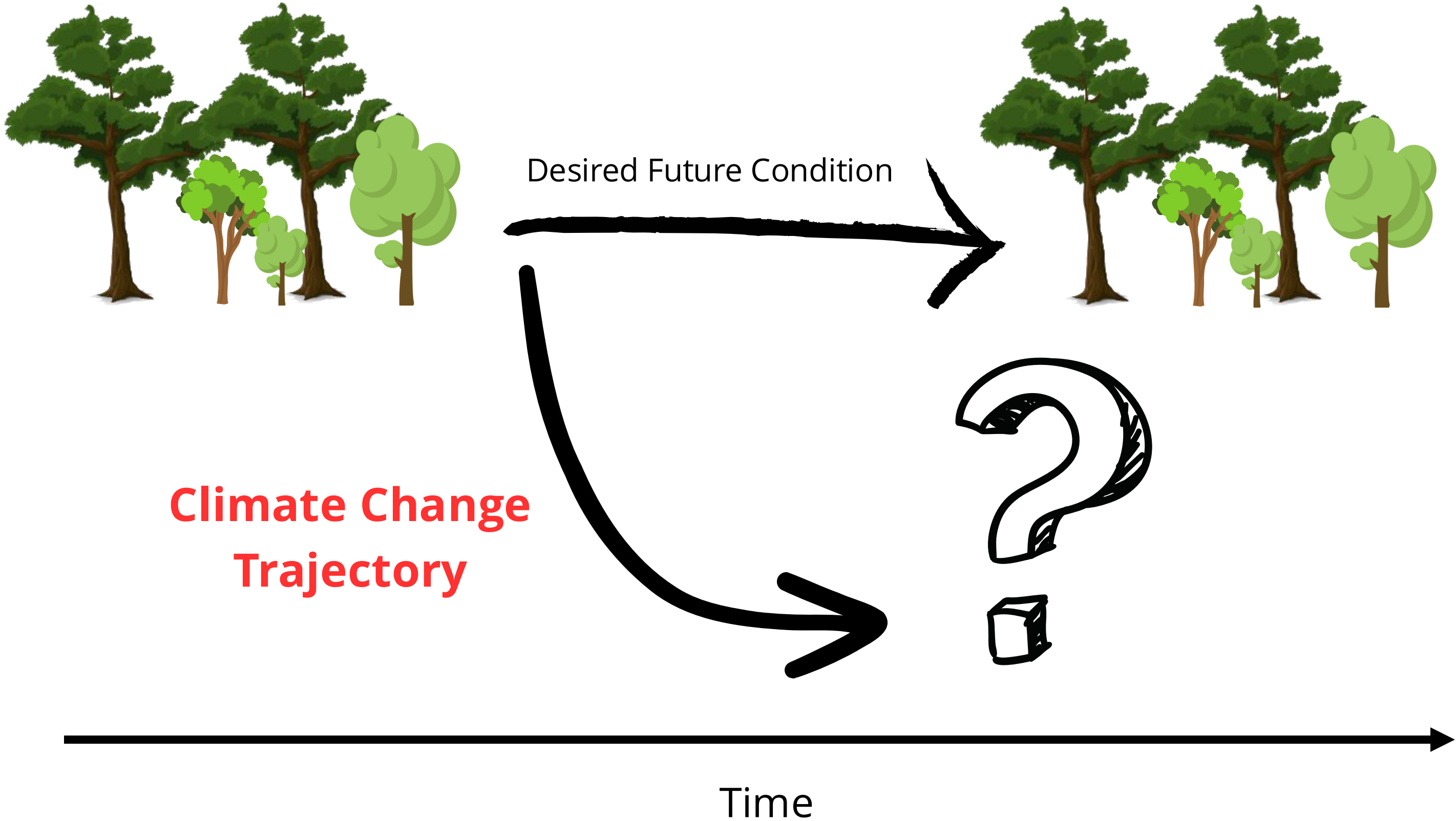
+ drought
Stress amplification

+ mortality



(-) BOTTOM-UP EFFECTS

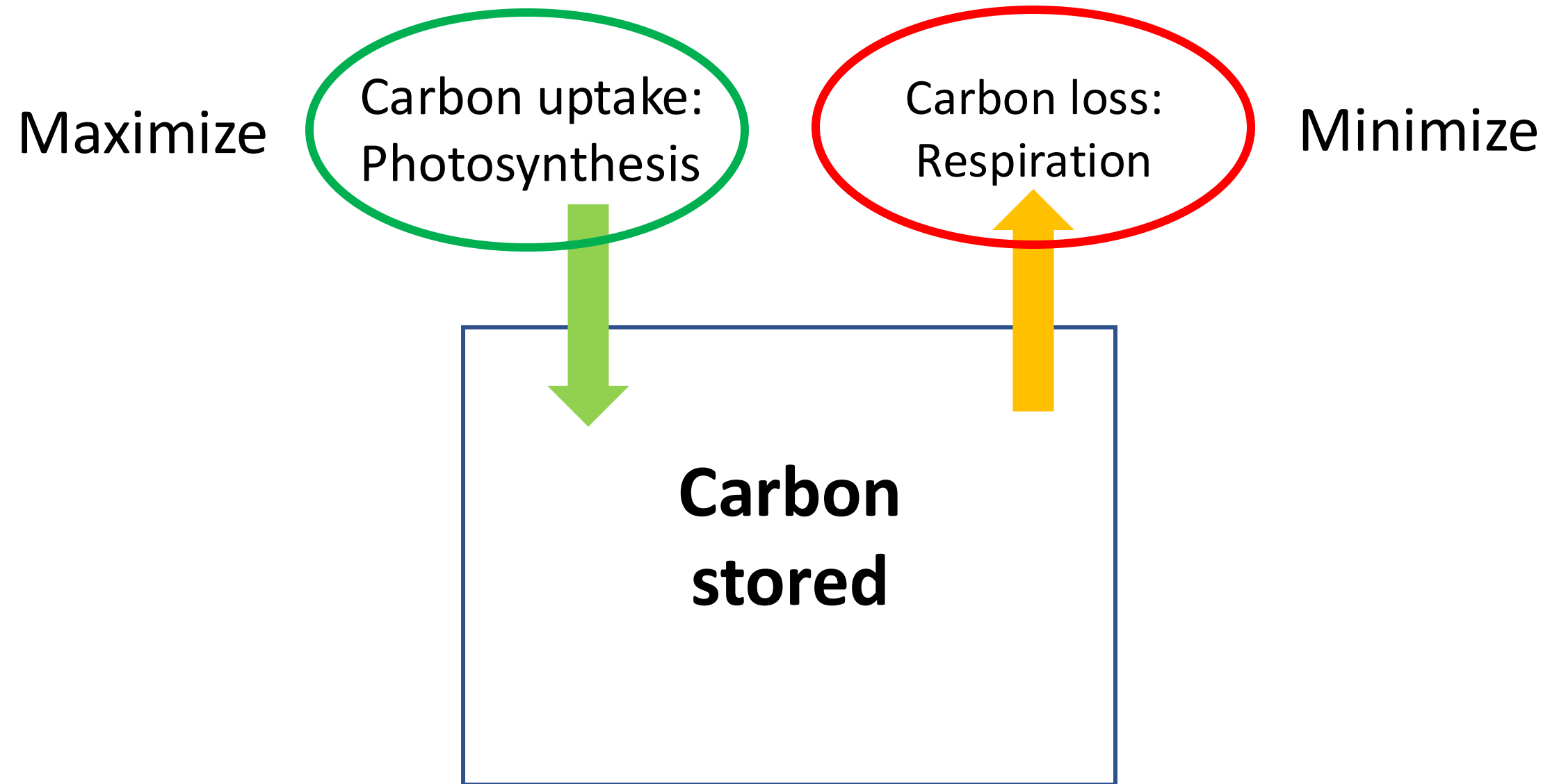
Climate Change and PA forests: are we prepared for future transitions?





Forest **governance** is key in fighting **climate change**

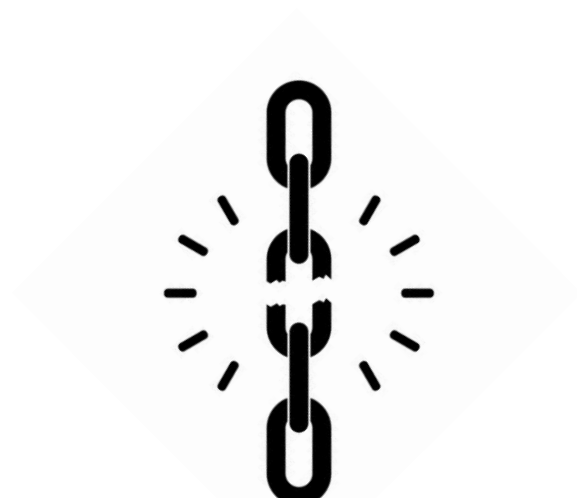
How? Providing guidelines for managing carbon



Climate-Smart Forestry

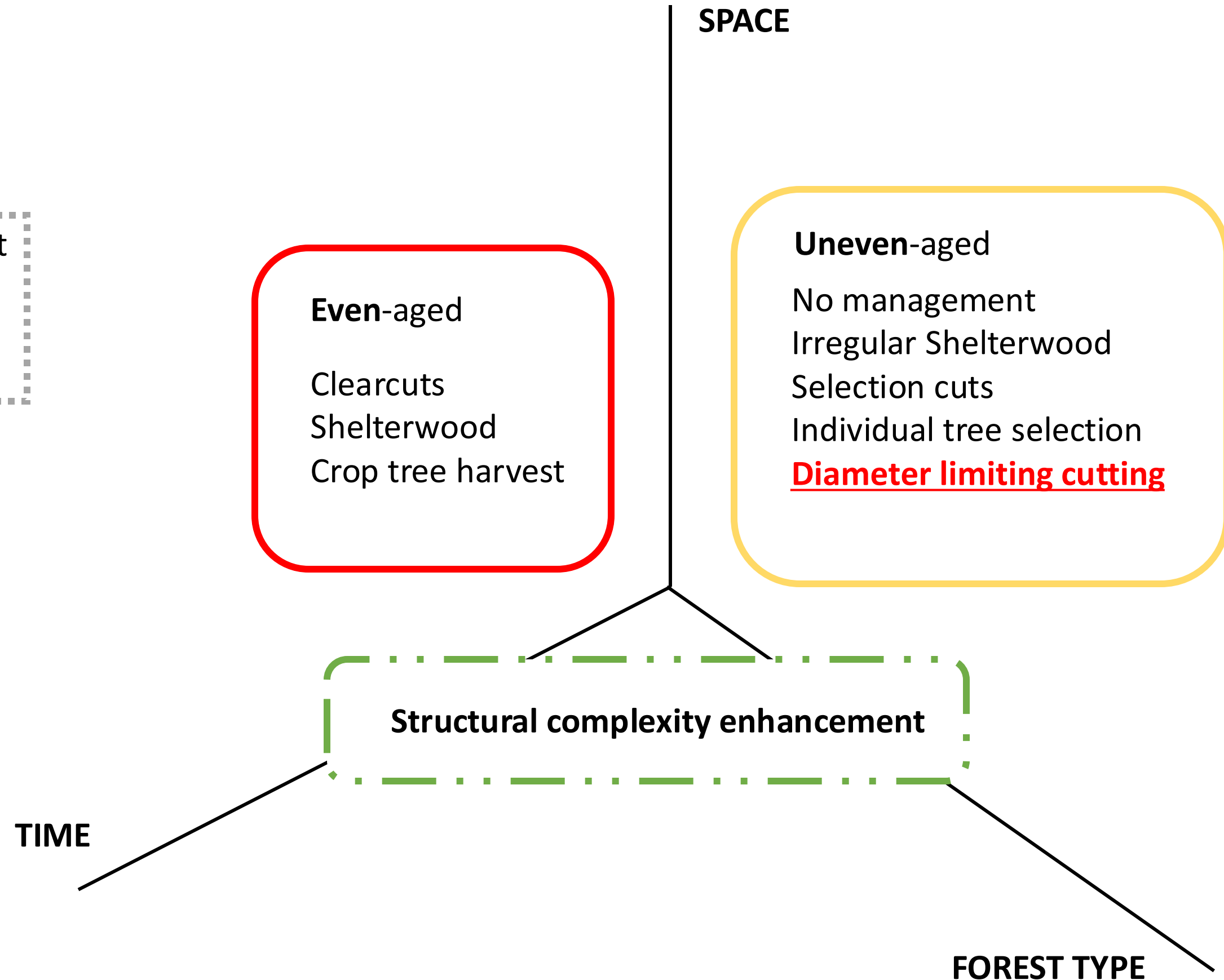
The complexity of IFM : an Eastern US perspective

“IFM encompasses a range of silvicultural management actions that incorporate above- and below-ground biomass C components, as well soil C stocks.”-
Kaarakka et al., (2021)

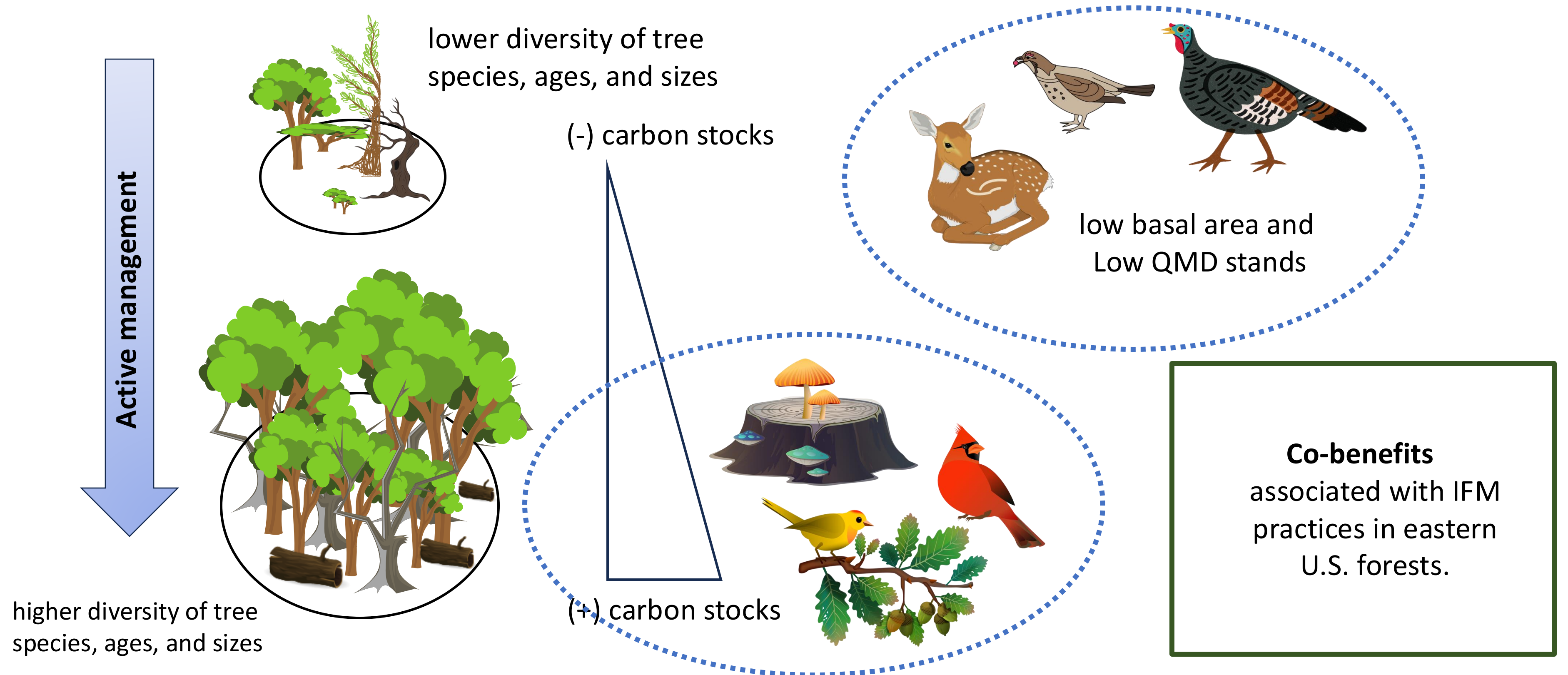


- 1. Hardwood Products (HWP) **OUTSIDE**
- 2. Coarse Woody Debris (CWD)
- 3. Emissions (?)

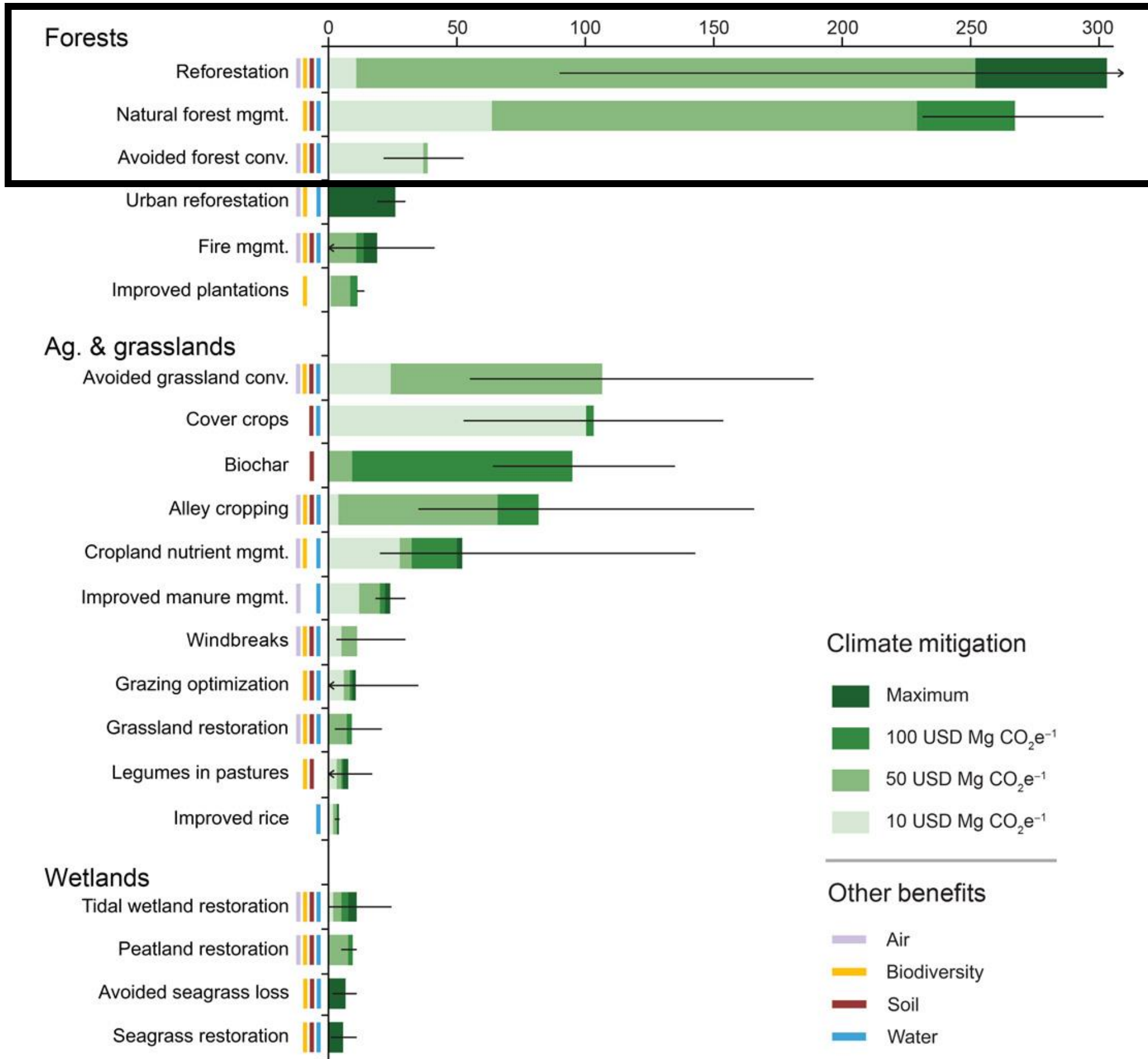
IFM- Improved Forest Management



Improving structural diversity lead to increased C benefits and forest resilience



Climate mitigation potential in 2025 (Tg CO₂e year⁻¹)

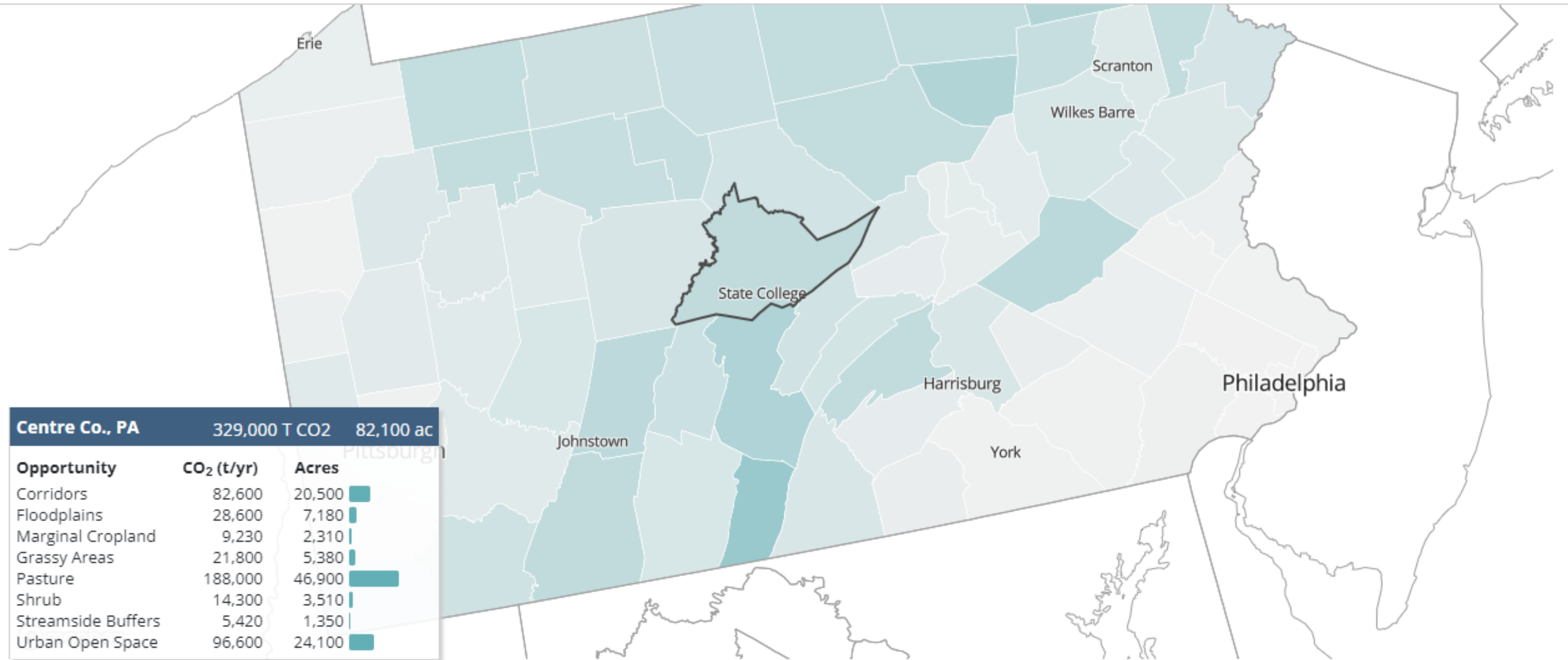


Forests are perhaps the most vital terrestrial carbon (C) pool in the United States providing the largest net offset to domestic fossil fuel emissions. (D'Amato et al., 2022)

Young forests and a diverse age structure at the landscape level can achieve greater levels of C uptake and sequestration.

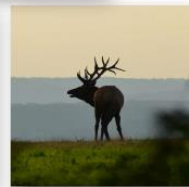
Where on earth are we going to put all those trees?

REFORESTATION HUB



“Policies that lower the cost and barrier of reforestation for private landowners will help us seize this important opportunity to restore forests and capture carbon.”

Pennsylvania Forest Action Plan



December 2020

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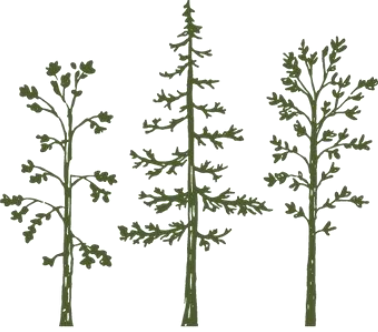


Pennsylvania Forest Stewards



Strategies to improve Forest **Governance**

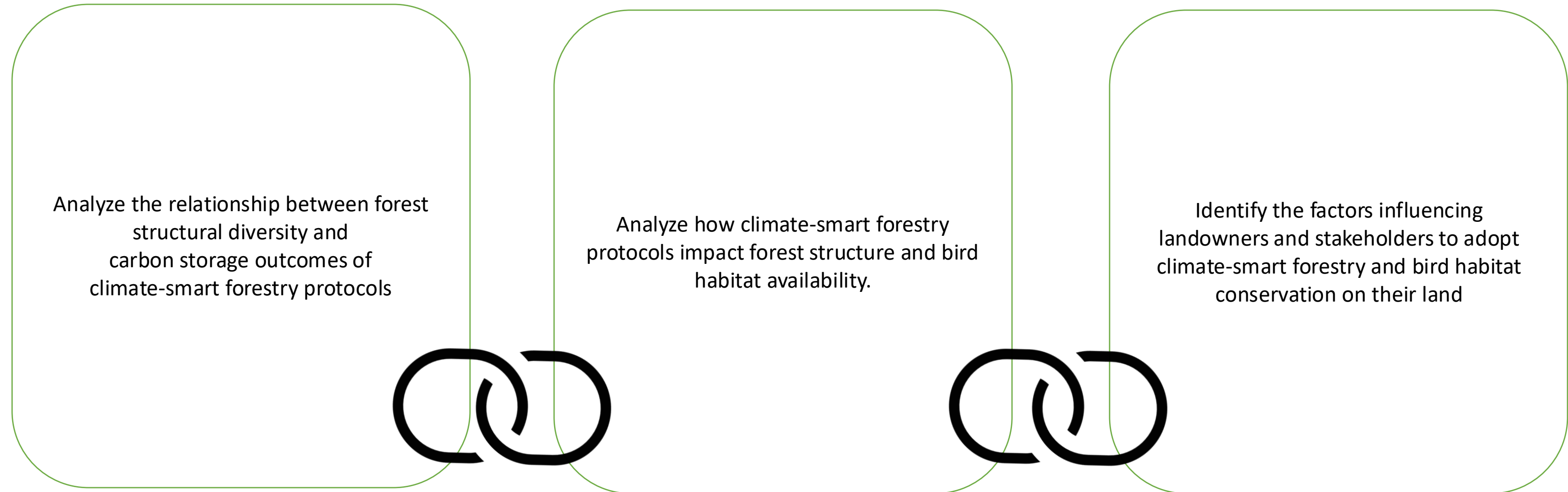
No forest **governance** can effectively address climate issues without focusing on interest groups and individuals.



THE JAMES C. FINLEY
CENTER FOR PRIVATE FORESTS



Increasing structural diversity supports **diverse habitats** and **carbon storage** by enhancing ecosystem **resilience** through **biodiversity conservation** (Thom & Keeton, 2020).



“Advancing the Co-benefits of Climate-Smart Forestry through Research and Extension in Pennsylvania’s Private Forestlands”
McIntire Stennis 2025-2026





Forest **governance** is key in fighting **climate change**

COLLABORATIONS

Climate and forests: bridging **Governance** and **Carbon**

Thank you!

Q & A section



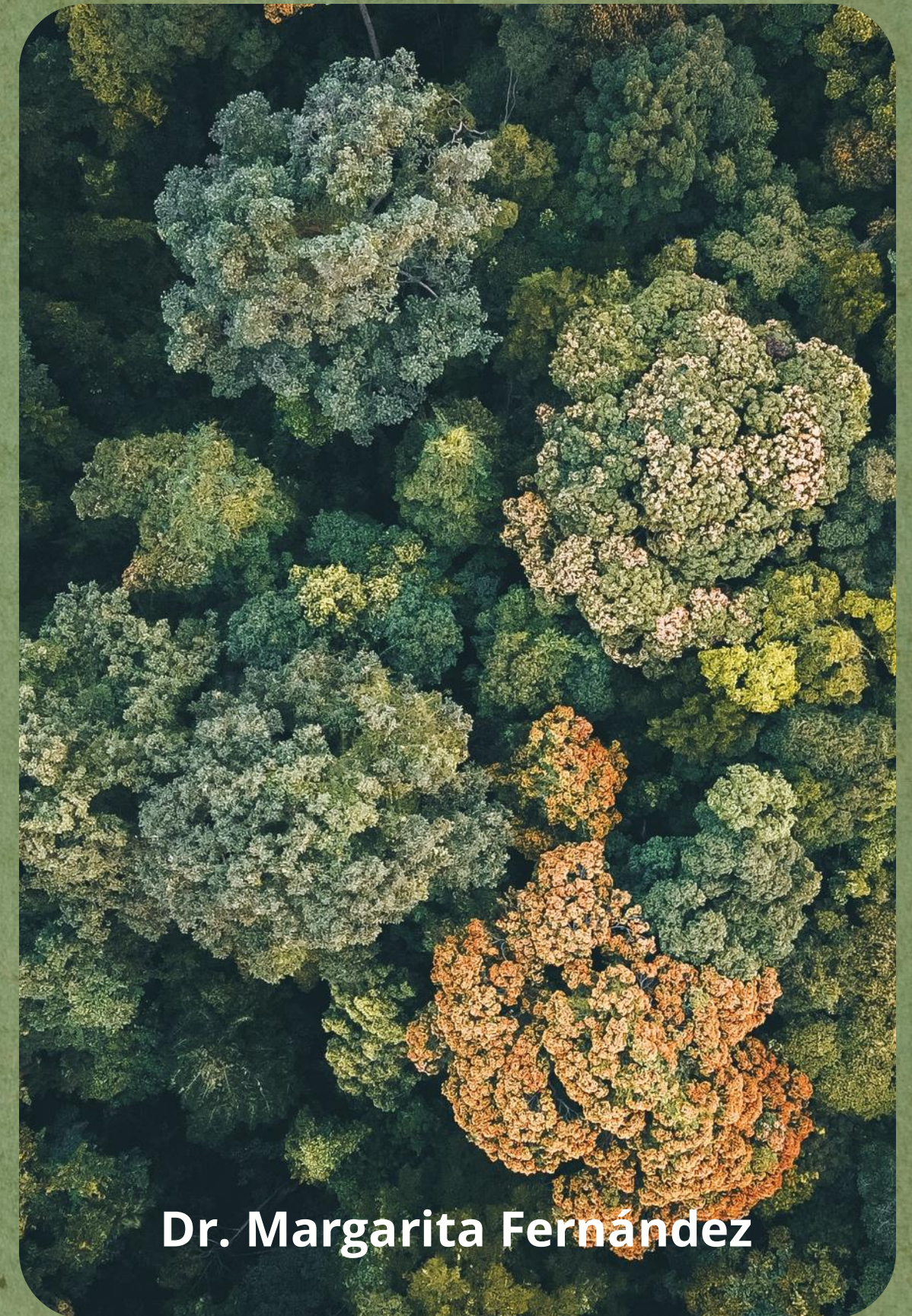
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FOCCE

Forest Owner Carbon and Climate Education



Dr. Margarita Fernández